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Interaction of polyacrylic acid with lipid bilayers: Effect of polymer mass

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Abstract

Polyanion-coated lipid vesicles are proposed to have an appreciable potential for drug delivery because of their ability to control the permeability of lipid bilayers by environmental parameters such as pH and temperature. However, details of the interaction of this class of polymers with lipids and their mechanisms of induced permeability are still being debated. In this work, we applied 1H NOESY to study details of the interaction of polyacrylic acid (PAA) fractions of molecular weights 5 and 240 kDa with dimyristoylphosphatidylcholine vesicles. We showed that PAA of two different molecular masses modifies lipid bilayers increasing disorder and probability of close contact between polar and hydrophobic groups. PAA molecules adsorb near the interface of lipid bilayers but do not penetrate into the hydrophobic core of the bilayer and, thus, cannot participate in formation of transbilayer channels, proposed in earlier works. Increasing the molecular mass of PAA from 5 kDa to 240 kDa does not change the effect of PAA on the bilayer, although PAA240 forms a more compact structure (either intra-molecular or inter-molecular) and interacts more strongly with interface lipid protons. Copyright © 2013 John Wiley & Sons, Ltd. Polyacrylic acid (PAA) molecules adsorb near the interface of lipid bilayers but do not penetrate into the hydrophobic core of the bilayer. Increasing the molecular mass of PAA from 5 to 240 kDa does not change the effect of PAA on the bilayer, although PAA240 forms a more compact structure (either intra-molecular or inter-molecular) and interacts more strongly with interface lipid protons. Copyright © 2013 John Wiley & Sons, Ltd.

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Keywords

1H NOESY NMR, biomembrane, polymer